INJECTION IMPLEMENTATION PLAN

Former Boeing C-6 Facility
Los Angeles, California

PREPARED FOR

Boeing Realty Corporation
3855 Lakewood Blvd., Bldg. 1A
MC D00-0097
Long Beach, California

ARCADIS

ARCADIS

James K. Nguyen, P.E.
Project Manager

Eric D. Lothman
Project Engineer

Kenneth W. P. Thomas
Area Manager

INJECTION IMPLEMENTATION PLAN

Former Boeing C-6 Facility
Los Angeles, California

Prepared for:
Boeing Realty Corporation
3855 Lakewood Blvd., Bldg. 1A
MC D00-0097
Long Beach, California

Prepared by:
ARCADIS G&M, Inc.
1400 No. Harbor Boulevard
Suite 700
Fullerton
California 92835-4127
Phone 714.278.0992
Fax 714.278.0051

Our Ref.:
CA000594.0003.00001

Date:
3 February 2004

Figures

Appendices

1. Introduction and Background

Boeing Realty Corporation (BRC) has investigated groundwater at the former C-6 Facility (Site) located in Los Angeles, California. The site location map is illustrated on Figure 1. Investigations have shown the presence of volatile organic compounds (VOCs) in groundwater at certain areas of the Site. To facilitate groundwater remediation, *In-Situ* Reactive Zone (IRZ) technology was selected to optimize and enhance biodegradation of VOCs. Amendment points have been installed at the Site to provide a mechanism to deliver carbohydrate solution to target the impacted groundwater. The points were installed between 75 and 125 feet below ground surface and constructed with 10, 15, 20, or 25 feet of screen. The points were connected via lateral pipes to access vaults located along the perimeter of the buildings (Figure 2). Food grade carbohydrate solution will be injected to each amendment point to create a reactive zone at and downgradient of the well screen. A network of groundwater monitoring wells has also been installed at the Site to monitor the progress of the IRZ.

The purposes of this Injection Implementation Plan (IIP) are:

- Describe the main components of the injection system;
- Provide the logistics to implement the injection program; and
- Provide administrative documents: public communication plan, spill prevention plan, and incident reporting procedures.

2. Injection System Components

There are several main components to deliver carbohydrate solution to the amendment points. These components include tanker trucks, injection system manifold, transfer hoses, and amendment point wellheads. Each component is discussed in the sections below.

2.1 Tanker Trucks

An industrial food supplier will mix and transport the carbohydrate solution to the Site. The food supplier will be provided with instructions regarding the percent carbohydrate solution and sodium bicarbonate required for the reagent injectant mix. For quality control and quality assurance, a water sample from the facility's source water supply (being used for mixing the reagent) will be collected and analyzed for

VOCs. In addition, the water supplier will be identified and, if available, a water quality report will be obtained from the supplier. In addition, the carbohydrate solution will be sampled from select tanker trucks and analyzed for Total Organic Carbon (TOC) to determine the TOC of the carbohydrate solution.

The carbohydrate solution will be mixed at the food supplier facility in a 25,000-gallon mixing tank. The facility is a food-grade facility, thoroughly sanitized and inspected. The injection solution will be delivered to the site in food-grade tanker trucks. Each truck is equipped with an internal wash rack to rinse the inside with hot water for cleaning and sanitizing. Once the truck is empty, the tanker is rinsed until the discharge water is clean, and then rinsing continues for another twenty minutes. The rinsing and sanitizing of the tanker trucks occurs at the food supplier facility. Rinse water is processed through a clarifier and discharged under the facility's site-specific discharge permit.

Each tanker truck is equipped with a hydraulic diaphragm pump for dispensing the injection solution. The pumps are capable of supplying a maximum flow rate of 100 gallons per minute (gpm), and a maximum pressure of 100 pounds per square inch (psi). The pump is located at the bottom of the tanker truck in the center of the trailer. The pump can dispense the solution out either side of the truck. Each truck comes equipped with four, twenty-foot hoses to connect from their pump to the injection manifold (Section 3.2). Each hose is three inches nominal diameter with aluminum quick connect camlock fittings.

The tanker trucks are 65 feet long and 10 feet wide. The maximum weight capacity of each truck is 80,000 pounds, which includes the weight of the truck itself. Each truck is capable of carrying 5,000 gallons of injection solution.

2.2 Injection Manifold and Components

Three injection manifolds will be built for the injection program. The approximate size of the manifold is 3 feet by 5 feet. Each injection manifold consists of twelve injection arms, each consisting of a brass globe valve, flow totalizer, pressure gauge, bronze check valve, and quick connect camlock fittings. One additional arm will be constructed for each manifold for exchanging any malfunctioning component in the field in case a rapid repair is necessary. This procedure will allow the injection to continue with minimal downtime. The manifold is built with 1-inch diameter galvanized steel pipe and fittings. The connection on the supply side for the tanker truck is a 3-inch male aluminum camlock fitting.

Globe valves were selected to control the flow rate of the injection solution because of their throttling capabilities. The flow totalizer is capable of flow rates in the range of 3 to 30 gallons per minute (gpm). Each flow totalizer display is battery operated and has a reset button to clear the display. The turbine totalizer mechanics consist of wetted parts made of Tungsten carbide, ceramic, type 316 stainless steel, and aluminum. The rotor is magnetically coupled to a gearing mechanism which registers the number of rotations, and can be used with fluids that have a moderate solids content. Based on injection pressure test data, the injection rates into the amendment points were in the range of 2.5 to 20 gpm. One amendment point (IRZB-27A) had an injection rate of approximately one gpm. Since this rate is below the range of the totalizers, one totalizer with a lower flow range will be purchased specifically for this point, and will be installed onto a separate injection arm.

The pressure gauge is located downstream of the globe valve to indicate the injection pressure at the vault connection. The bronze check valve is a spring-loaded swing check valve, which can be mounted in the vertical position. The check valve will prevent any backflow from the vault or other lines. Each arm is connected to the main manifold by a double-shut off quick connect fitting. This will allow for easy interchange of injection arms in the event of malfunction or necessary repairs. The quick connect fitting has a valve on each end which closes during disconnection which will minimize spilling injection solution, and will allow for interchange without stopping injection.

2.3 Injection Transfer Hoses

The injection solution will be transferred from the injection manifold to the individual amendment points through 25-foot sections of 1" flexible hose. Each hose will have cam and groove type (camlock) fittings for quick connections and facilitate interchanging between injection wells. The hose is constructed of EPDM rubber with polyester yarn reinforcement with a maximum working pressure of 200 psi.

2.4 Amendment Point Identification

Each amendment point will be color-coded to match the injection volume for easy coordination in the field. The following table indicates the selected color scheme for each injection volume.

Screen Length	Injection Volume	Color Code
25 feet	1,200 gallons	Red
20 feet	960 gallons	White
15 feet	720 gallons	Blue
10 feet	480 gallons	Green
Bromide Injection Wells	Varies	Yellow

Each well will be color-coded with the appropriate colored cable tie. Plastic cable ties will be used instead of paint for a more permanent marking since the vaults will be periodically washed down for cleaning.

3. Injection Logistics

The injection volume, pressure, and logistics for the injection program are described in the sections below.

3.1 Injection Volume and Pressure

The injection volume for each well is based on the screen length of the amendment point. Details regarding the screen length and injection volume are listed in Table 1. The injection pressure will be varied in the field and will be dictated on the characteristics of each individual point (i.e. size of the point, geology, and length of lateral line from the vault to the amendment point). During pressure testing, the injection pressure varied from less than 2 pounds per square inch (psi) to a maximum of 20 psi at the wellhead. Because the solution will be injected through various distances of ¾-inch diameter process pipe, the injection pressure must account for the pressure loss through the process piping. At a flow rate of 10 gallons per minute, the pressure loss is approximately 13 psi per 100-foot length of pipe. Initially, the injection pressure will be incrementally increased to a target of 50 psi, and then field adjusted based on the reaction of the amendment point pressure fluctuations.

At the end of each day, the completed wells will be flushed with 25 gallons of water. The water will be supplied from a 500-gallon water trailer equipped with a trash pump.

The supply line will be connected to the manifold to keep track of the amount of water injected into each desired well. The water serves to clean out the manifold to minimize fouling of the components and to flush out the injection solution remaining in the process lines into the well. Additionally, it serves to flush out the process lines to avoid fouling in the process lines between injection events.

3.2 Order of Injection

The order of injection has been tentatively set for each vault. Details of the preliminary injection order are listed in Table 1. The injection order will also be dependent on field parameters. As the points are connected to the injection manifold, the flow rate will vary with each well depending on the length of process piping, screen length and subsurface lithology. As each point completes the desired injection volume, it will be disconnected from the injection manifold. Once a point is completed, the next well in order will be connected to the injection manifold. In this manner, if a particular well is accepting the solution at a slower pace, it will not slow down the entire project, but may be connected to multiple tanker loads until the desired volume has been added.

The injection solution will be delivered to the site using three tanker trucks that will be operated in parallel. The injection program will begin with a single truck at each of three vaults (1, 2 and 3). Vault 4 will be accessed as soon as one of the other vaults is complete.

3.3 Truck and Manifold System Layout

The injection manifold will be set into the back of a pick-up truck, with the flexible hoses draping over the side of the truck bed. The pick-up trucks and tanker trucks will set up in tandem along the curb directly in front of the well vaults. Prior to each event, the building tenets will be notified of the site activities and request that the area near the vaults remain clear of any vehicles. The pick-up truck will be backed into the nearest parking spot adjacent to Vault 2, since there is insufficient curb space in front of this vault for both trucks to park. The specific parking spot near the vault will be blockaded with safety cones during the injection event to secure availability. Figure 3 shows the layout of the truck positioning. With this arrangement, there is sufficient space for vehicles to pass without blocking traffic. During the injection event, safety cones will be placed near the tanker trucks and pick-up trucks to divert traffic and provide traffic control. In the event that two vaults are completed, Figure 4 shows the potential layout of the truck positioning for two trucks injecting into one of the remaining vaults.

3.4 Injection with Bromide Tracer

The injection solution containing the potassium bromide tracer will be delivered to the site in a separate tanker truck. The separate tanker will be tested and certified for cleanliness prior to accepting delivery of the solution. This load will be the final tanker load of the injection event since it will be injecting into wells in Vaults #1, 3, and 4.

3.5 Field Notes and Data Log

Field notes and injection data will be listed on Daily Field Sheets. Field notes will include observations of injection flow rates, tanker truck arrival and departure times, injection pressures, injection volumes, water flush volumes, and highlight any difficulties encountered with the injection program. Injection data will be evaluated on a daily basis to assess the progress of the injection event. Adjustments will be made if necessary to complete the injection event in the most efficient manner possible. A template of the Daily Field Sheet is included as Table 2.

3.6 Site Cleanup

At the end of each day, the project area will be hosed down with water. Any spills that may occur during the injection event will be dealt with immediately. The vaults will also be hosed down and pumped out at the end of each day to minimize final clean-up activities. Each vault is constructed with a small sump area for ease of cleaning the interior portion of the vault.

Additional procedures to handle spills are outlined in the Spill Prevention and Response (SPR) Plan discussed in Section 6.

3.7 Storage of Injection System

The injection manifolds can be stored on site in the vapor extraction compound, if sufficiently secured. If necessary, each injection arm can be disconnected from the manifold and stored separately in a lock box, or offsite. The transfer hoses can be coiled up and stored in the vapor extraction compound.

3.8 Potential Risk and Risk Management

One of the potential risks with the injection program is the slow acceptance of injection fluid to a particular amendment point. This would lead to delays in completing the injection event. To minimize this risk, the low-flow rate amendment points have been

identified from the pressure test data and will be targeted for injection at the beginning of each day. By connecting these points at the beginning of each day, it allows the point to be injected at its own pace throughout the day and over several tanker truck loads without delaying other points. In addition, the wells that were not initially pressure tested will be targeted for injection at the beginning of an injection day. This will allow flow rate and pressure data to be collected on these wells and compensate for potentially low-flow rate conditions.

Because many of the amendment points are located beneath the site buildings, field personnel will observe the initial injection pressure, and monitor the injection pressure during injection. If the pressure drops off significantly during injection, it will be assumed that the amendment point has developed a breach in the well seal, and injection into that point will be stopped. Field personnel will note this occurrence in the field notes, and relay this information to the Field Manager. The Field Manager will then relay the information to the Project Manger. In the event that a particular well is rendered inactive, the risk management procedures will be to determine the up-gradient and lateral wells and proportionally increase the amendment solution volume into those wells to make-up for the volume intended for the inactive well.

If the injection event is halted for some unforeseen circumstance (i.e. injury, fire, equipment malfunction, etc.), the mixing facility is not set up to handle returns of the injection solution. Occurrences of this nature will inevitably accrue additional stand-by labor charges because any pre-mixed injection solution will have to be injected into the wells. The circumstance causing the delay will have to be remedied while the tanker truck stands by, or the tanker truck will be moved to another vault if possible.

4. Public Communication

In the event that the general public asks questions of field personnel regarding the injection activities, the field personnel will have an information sheet available for distribution. The information sheet will provide general information regarding the project, injection activities, and a contact list for additional information. The information sheet is included in Appendix A.

5. Spill Prevention and Response Plan

A Spill Prevention and Response (SPR) Plan has been prepared for the Site. The SPR Plan provides information and procedures for preventing spills and for responding to undesired discharges of carbohydrate solution to the ground surface and/or storm drains. The plan also includes information to contact an emergency response team in the event of a major spill. Personnel involved in the injection program will review and

understand the SPR Plan prior to the fieldwork. The SPR Plan was submitted to BRC as a separate document, dated January 30, 2004.

6. Incident Reporting Procedures

Incident reporting procedures have been prepared for the Site. The purpose of the procedures is to provide field personnel with the appropriate actions in the event of an incident. In addition, the procedures contain appropriate agency, Boeing, and site owner contacts. Personnel involved in the injection program will review and understand the procedures prior to the fieldwork. The written procedures are included as an appendix in the SPR Plan previously submitted to BRC.

7. Health and Safety Plan

Personnel working at the Site will follow the health and safety guidelines outlined in their Health and Safety Plan (HSP). ARCADIS personnel will adhere to the HSP dated June 24, 2002.

Tables

Table 1. Well Injection Data and Planned Injection Order
Former Boeing C-6 Facility, Los Angeles, California

Amendment Point ID	Wellhead Injection Flowrate (gpm)	Wellhead Injection Pressure (psi)	Screen Length	Molasses Injection Volume (gal)	Water Flush Volume (gal)	Bromide Tracer	Injection Order	Tanker Truck Load Number	Distance from Well to Vault (ft)	Estimated Headloss @ 7.5 gpm (psi)
VAULT 1 (51 Wells, 49,200 gallons injection volume)										
IRZB 1	8	8	25	1200	25		2	A,B,C	500	37.4
IRZB 2	7.5	5	25	1200	25		3	A,B,C	470	35.1
IRZB 3	12	<2	25	1200	25		4	A,B,C	440	32.9
IRZB 4	7.5	5	25	1200	25		5	A,B,C	410	30.7
IRZB 5	5	8	25	1200	25		6	A,B,C	380	28.4
IRZB 6	12	<2	25	1200	25		7	A,B,C	350	26.2
IRZB 7	12	<2	25	1200	25		8	A,B,C	320	23.9
IRZB 8	13	<2	25	1200	25		9	A,B,C	460	34.4
IRZB 9	12	<2	25	1200	25		10	A,B,C	430	32.2
IRZB 10	8	3	25	1200	25		11	A,B,C	400	29.9
IRZB 11	10.5	<2	25	1200	25		12	C	370	27.7
IRZB 12	11	<2	25	1200	25		13	C	340	25.4
IRZB 13	13	<2	25	1200	25		14	C,D	310	23.2
IRZB 14	11	<2	25	1200	25		15	D,E,F	280	20.9
IRZB 15	12	<2	25	1200	25		16	D,E,F	390	29.2
IRZB 16	9	<2	25	1200	25		17	D,E,F	360	26.9
IRZB 17	8	5	25	1200	25		18	D,E,F	330	24.7
IRZB 18	8	<2	25	1200	25		19	D,E,F	300	22.4
IRZB 19	15	<2	25	1200	25		20	D,E,F	270	20.2
IRZB 20	5	9	25	1200	25		21	D,E,F	240	18
IRZB 21	9	<2	25	1200	25		22	D,E,F	320	23.9
IRZB 22	7	4	25	1200	25		23	D,E,F	290	21.7
IRZB 23 A	12	<2	10	480	25		37	H	260	19.4
IRZB 23 B	5	14	15	720	25		33	G	260	19.4
IRZB 24	8	<2	25	1200	25		24	F,G	230	17.2
IRZB 25	15	<2	25	1200	25		25	F,G	200	15
IRZB 26 A	4.5	8	10	480	25		38	H,I	235	17.6
IRZB 26 B	12	<2	15	720	25		34	G	235	17.6
IRZB 27 A	1	20	10	480	25		1	A,B,C	205	15.3
IRZB 27 B	11	<2	15	720	25		35	G	205	15.3
IRZB 28	10	<2	25	1200	25		26	F,G	260	19.4
IRZB 29	14	<2	25	1200	25		27	F,G	170	12.7
IRZB 30 A	11	<2	10	480	25		44	I	230	17.2
IRZB 30 B	4	12	15	720	25		36	G,H	230	17.2
IRZB 31 A	3.5	12	10	480	25		45	I	200	15
IRZB 31 B	6	7	15	720	25		39	H	200	15
IRZB 32	5	<2	25	1200	25		28	F,G	320	23.9
IRZB 33 A	4	8	10	480	25		46	I	290	21.7
IRZB 33 B	11	<2	15	720	25		40	H	290	21.7
IRZB 34 A	4.5	9	10	480	25		47	I	260	19.4
IRZB 34 B	16	<2	15	720	25		41	H	260	19.4
IRZB 35	No test		25	1200	25		29	F,G	230	17.2
IRZB 36	13.5	<2	25	1200	25		30	F,G	200	15
IRZB 37 A	No test		10	480	25	X		Bromide	290	21.7
IRZB 37 B	No test		15	720	25	X		Bromide	290	21.7
IRZB 38 A	4.5	9	10	480	25		48	I	260	19.4
IRZB 38 B	12	<2	15	720	25		42	H	260	19.4
IRZB 39	13	<2	25	1200	25		31	F,G	320	23.9
IRZB 40	11	<2	25	1200	25		32	F,G	230	17.2
IRZB 42 A	5	11	10	480	25		49	I	320	23.9
IRZB 42 B	11	<2	15	720	25		43	H	320	23.9

Table 1. Well Injection Data and Planned Injection Order
Former Boeing C-6 Facility, Los Angeles, California

Amendment Point ID	Wellhead Injection Flowrate (gpm)	Wellhead Injection Pressure (psi)	Screen Length	Molasses Injection Volume (gal)	Water Flush Volume (gal)	Bromide Tracer	Injection Order	Tanker Truck Load Number	Distance from Well to Vault (ft)	Estimated Headloss @ 7.5 gpm (psi)
VAULT 2 (29 Wells, 24,000 gallons injection volume)										
IRZB 41	8	<2	25	1200	25		3	A,B,C	300	22.4
IRZB 43 A	6	7	10	480	25		23	D,E	290	21.7
IRZB 43 B	12	<2	15	720	25		14	C	290	21.7
IRZB 44	11	<2	25	1200	25		4	A,B,C	320	23.9
IRZB 45 A	4	7	10	480	25		24	E	290	21.7
IRZB 45 B	10	<2	15	720	25		15	C	290	21.7
IRZB 46 A	5	10	10	480	25		25	E	260	19.4
IRZB 46 B	14	<2	15	720	25		16	C,D	260	19.4
IRZB 47 A	2.5	5	10	480	25		1	A,B,C	230	17.2
IRZB 47 B	12	<2	15	720	25		17	D	230	17.2
IRZB 48	13	<2	25	1200	25		5	A,B,C	260	19.4
IRZB 49 A	2.5	15	10	480	25		2	A,B,C	290	21.7
IRZB 49 B	15	<2	15	720	25		18	D	290	21.7
IRZB 50 A	3	8	10	480	25		26	E	230	17.2
IRZB 50 B	8	<2	15	720	25		19	D	230	17.2
IRZB 51 A	9	5	10	480	25		27	E	200	15
IRZB 51 B	12	<2	15	720	25		20	D	200	15
IRZB 52	12	<2	25	1200	25		6	A,B,C	290	21.7
IRZB 53	10.5	<2	25	1200	25		7	A,B,C	170	12.7
IRZB 54 A	4	12	10	480	25		28	E	260	19.4
IRZB 54 B	8	4	15	720	25		21	D	260	19.4
IRZB 55 A	12	<2	10	480	25		29	E	230	17.2
IRZB 55 B	11	<2	15	720	25		22	D	230	17.2
IRZB 56	14	<2	25	1200	25		8	A,B,C	200	15
IRZB 57	13	<2	25	1200	25		9	A,B,C	300	22.4
IRZB 58	12	<2	25	1200	25		10	A,B,C	290	21.7
IRZB 59	9	<2	25	1200	25		11	A,B,C	260	19.4
IRZB 60	13	<2	25	1200	25		12	A,B,C	230	17.2
IRZB 61	12	<2	25	1200	25		13	C	260	19.4
VAULT 3 (38 Wells, 45,600 gallons injection volume)										
IRZB 62	15	13	25	1200	25		3	A,B,C	580	43.4
IRZB 63	12	<2	25	1200	25		4	A,B,C	600	44.9
IRZB 64	8	4	25	1200	25		5	A,B,C	570	42.6
IRZB 65	11	<2	25	1200	25		6	A,B,C	540	40.4
IRZB 66	12	<2	25	1200	25		7	A,B,C	510	38.2
IRZB 67	12	<2	25	1200	25		8	A,B,C	540	40.4
IRZB 68	16	14	25	1200	25		9	A,B,C	540	40.4
IRZB 69	10	<2	25	1200	25		10	A,B,C	550	41.1
IRZB 70	10	<2	25	1200	25		11	C,D,E	520	38.9
IRZB 71	11	<2	25	1200	25		12	C,D,E	490	36.7
IRZB 72	12	<2	25	1200	25		13	C,D,E	460	34.4
IRZB 73	11.5	<2	25	1200	25		14	C,D,E	490	36.7
IRZB 74	15	13	25	1200	25		15	C,D,E	550	41.1
IRZB 75	15	13	25	1200	25		16	C,D,E	520	38.9
IRZB 76	16	11	25	1200	25		17	C,D,E	490	36.7
IRZB 77	12	<2	25	1200	25		18	C,D,E	480	35.9
IRZB 78	9.5	<2	25	1200	25		19	C,D,E	450	33.7
IRZB 79	12	<2	25	1200	25		20	C,D,E	420	31.4
IRZB 80	16	12	25	1200	25		21	E,F,G	540	40.4
IRZB 81	16	10	25	1200	25	X			510	38.2
IRZB 82	18	9	25	1200	25		22	E,F,G	480	35.9
IRZB 83	16	12	25	1200	25		23	E,F,G	450	33.7
IRZB 84	8.5	4	25	1200	25		24	E,F,G	440	32.9

Table 1. Well Injection Data and Planned Injection Order
Former Boeing C-6 Facility, Los Angeles, California

Amendment Point ID	Wellhead Injection Flowrate (gpm)	Wellhead Injection Pressure (psi)	Screen Length	Molasses Injection Volume (gal)	Water Flush Volume (gal)	Bromide Tracer	Injection Order	Tanker Truck Load Number	Distance from Well to Vault (ft)	Estimated Headloss @ 7.5 gpm (psi)
IRZB 85	7	6	25	1200	25		25	E,F,G	410	30.7
IRZB 86	11	<2	25	1200	25		26	E,F,G	380	28.4
IRZB 87	14	15	25	1200	25		27	E,F,G	520	38.9
IRZB 88	15	15	25	1200	25		28	E,F,G	490	36.7
IRZB 89	16	13	25	1200	25		29	E,F,G	460	34.4
IRZB 90	16	14	25	1200	25		30	E,F,G,H	430	32.2
IRZB 91	15	18	25	1200	25		31	H,I	400	29.9
IRZB 92	11.5	<2	25	1200	25		32	H,I	370	27.7
IRZB 93	8	4	25	1200	25		33	H,I	340	25.4
IRZB 94	19	8	25	1200	25		34	H,I	450	33.7
IRZB 95	16	15	25	1200	25	X			420	31.4
IRZB 96	17	15	25	1200	25		35	H,I	390	29.2
IRZB 97	14	15	25	1200	25		36	H,I	360	26.9
IRZB 98	No test		25	1200	25		1	A,B,C	330	24.7
IRZB 99	No test		25	1200	25		2	A,B,C	300	22.4
VAULT 4 (20 Wells, 19,200 gallons injection volume)										
IRZC 1	16	18	20	960	25		2	A,B	480	35.9
IRZC 2	24	5	20	960	25		3	A,B	510	38.2
IRZC 3	24	<2	20	960	25		4	A,B	510	38.2
IRZC 4	24	4	20	960	25	X		Bromide	480	35.9
IRZC 5	24	4	20	960	25		5	A,B	450	33.7
IRZC 6	24	4	20	960	25		6	A,B	480	35.9
IRZC 7	18	3	20	960	25		7	A,B	300	22.4
IRZC 8	18	<2	20	960	25		8	A,B	330	24.7
IRZC 9	17	<2	20	960	25		9	A,B	360	26.9
IRZC 10	24	4	20	960	25		10	A,B	390	29.2
IRZC 11	24	4	20	960	25		11	B,C	420	31.4
IRZC 12	20	10	20	960	25		12	C,D	450	33.7
IRZC 13	6	10	20	960	25		13	C,D	330	24.7
IRZC 14	14	<2	20	960	25		14	C,D	360	26.9
IRZC 15	16	<2	20	960	25		15	C,D	390	29.2
IRZC 16	17.5	<2	20	960	25		16	C,D	420	31.4
IRZC 17	22	6	20	960	25		17	C,D	450	33.7
IRZC 18	19	<2	20	960	25		18	C,D	460	34.4
IRZC 19	19	<2	20	960	25		19	C,D	430	32.2
IRZC 20	No test		20	960	25		1	A,B	460	34.4

Table 2. Field Data Sheet - IRZ Injection
Former Boeing C-6 Facility, Los Angeles, California

Amendment Point #	Vault #	Date	Start Time	End Time	Injection Data						Carbohydrate Solution	Tanker Truck Load #	Comments
					Totalizer Readings		Design Injection Volume	Estimated Headloss @ 7.5 gpm	Actual Injection Pressure	Injection Flowrate			
					Initial	Final	(gals)	(psi)	(psi)	(gpm)	(%)		
IRZB-1	1						1200	37.4					
IRZB-2	1						1200	35.1					
IRZB-3	1						1200	32.9					
IRZB-4	1						1200	30.7					
IRZB-5	1						1200	28.4					
IRZB-6	1						1200	26.2					
IRZB-7	1						1200	23.9					
IRZB-8	1						1200	34.4					
IRZB-9	1						1200	32.2					
IRZB-10	1						1200	29.9					
IRZB-11	1						1200	27.7					
IRZB-12	1						1200	25.4					
IRZB-13	1						1200	23.2					
IRZB-14	1						1200	20.9					
IRZB-15	1						1200	29.2					
IRZB-16	1						1200	26.9					
IRZB-17	1						1200	24.7					
IRZB-18	1						1200	22.4					

Table 2. Field Data Sheet - IRZ Injection
Former Boeing C-6 Facility, Los Angeles, California

Amendment Point #	Vault #	Date	Start Time	End Time	Injection Data						Carbohydrate Solution	Tanker Truck Load #	Comments
					Totalizer Readings		Design Injection Volume	Estimated Headloss @ 7.5 gpm	Actual Injection Pressure	Injection Flowrate			
					Initial	Final	(gals)	(psi)	(psi)	(gpm)	(%)		
IRZB-19	1						1200	20.2					
IRZB-20	1						1200	18					
IRZB-21	1						1200	23.9					
IRZB-22	1						1200	21.7					
IRZB-23A	1						480	19.4					
IRZB-23B	1						720	19.4					
IRZB-24	1						1200	17.2					
IRZB-25	1						1200	15					
IRZB-26A	1						480	17.6					
IRZB-26B	1						720	17.6					
IRZB-27A	1						480	15.3					
IRZB-27B	1						720	15.3					
IRZB-28	1						1200	19.4					
IRZB-29	1						1200	12.7					
IRZB-30A	1						480	17.2					
IRZB-30B	1						720	17.2					
IRZB-31A	1						480	15					
IRZB-31B	1						720	15					

Table 2. Field Data Sheet - IRZ Injection
Former Boeing C-6 Facility, Los Angeles, California

Amendment Point #	Vault #	Date	Start Time	End Time	Injection Data						Carbohydrate Solution	Tanker Truck Load #	Comments
					Totalizer Readings		Design Injection Volume	Estimated Headloss @ 7.5 gpm	Actual Injection Pressure	Injection Flowrate			
					Initial	Final	(gals)	(psi)	(psi)	(gpm)	(%)		
IRZB-32	1						1200	23.9					
IRZB-33A	1						480	21.7					
IRZB-33B	1						720	21.7					
IRZB-34A	1						480	19.4					
IRZB-34B	1						720	19.4					
IRZB-35	1						1200	17.2					
IRZB-36	1						1200	15					
IRZB-37A	1						480	21.7					
IRZB-37B	1						720	21.7					
IRZB-38A	1						480	19.4					
IRZB-38B	1						720	19.4					
IRZB-39	1						1200	23.9					
IRZB-40	1						1200	17.2					
IRZB-42A	1						480	23.9					
IRZB-42B	1						720	23.9					

Table 2. Field Data Sheet - IRZ Injection
Former Boeing C-6 Facility, Los Angeles, California

Amendment Point #	Vault #	Date	Start Time	End Time	Injection Data						Carbo-hydrate Solution	Tanker Truck Load #	Comments
					Totalizer Readings		Design Injection Volume	Estimated Headloss @ 7.5 gpm	Actual Injection Pressure	Injection Flowrate			
					Initial	Final	(gals)	(psi)	(psi)	(gpm)	(%)		
IRZB-41	2						1200	22.4					
IRZB-43A	2						480	21.7					
IRZB-43B	2						720	21.7					
IRZB-44	2						1200	23.9					
IRZB-45A	2						480	21.7					
IRZB-45B	2						720	21.7					
IRZB-46A	2						480	19.4					
IRZB-46B	2						720	19.4					
IRZB-47A	2						480	17.2					
IRZB-47B	2						720	17.2					
IRZB-48	2						1200	19.4					
IRZB-49A	2						480	21.7					
IRZB-49B	2						720	21.7					
IRZB-50A	2						480	17.2					
IRZB-50B	2						720	17.2					
IRZB-51A	2						480	15					
IRZB-51B	2						720	15					

Table 2. Field Data Sheet - IRZ Injection
Former Boeing C-6 Facility, Los Angeles, California

Amendment Point #	Vault #	Date	Start Time	End Time	Injection Data						Carbo-hydrate Solution	Tanker Truck Load #	Comments
					Totalizer Readings		Design Injection Volume	Estimated Headloss @ 7.5 gpm	Actual Injection Pressure	Injection Flowrate			
					Initial	Final	(gals)	(psi)	(psi)	(gpm)	(%)		
IRZB-52	2						1200	21.7					
IRZB-53	2						1200	12.7					
IRZB-54A	2						480	19.4					
IRZB-54B	2						720	19.4					
IRZB-55A	2						480	17.2					
IRZB-55B	2						720	17.2					
IRZB-56	2						1200	15					
IRZB-57	2						1200	22.4					
IRZB-58	2						1200	21.7					
IRZB-59	2						1200	19.4					
IRZB-60	2						1200	17.2					
IRZB-61	2						1200	19.4					

Table 2. Field Data Sheet - IRZ Injuection
Former Boeing C-6 Facility, Los Angeles, California

Amendment Point #	Vault #	Date	Start Time	End Time	Injection Data						Carbo-hydrate Solution	Tanker Truck Load #	Comments
					Totalizer Readings		Design Injection Volume	Estimated Headloss @ 7.5 gpm	Actual Injection Pressure	Injection Flowrate			
					Initial	Final	(gals)	(psi)	(psi)	(gpm)	(%)		
IRZB-62	3						1200	43.4					
IRZB-63	3						1200	44.9					
IRZB-64	3						1200	42.6					
IRZB-65	3						1200	40.4					
IRZB-66	3						1200	38.2					
IRZB-67	3						1200	40.4					
IRZB-68	3						1200	40.4					
IRZB-69	3						1200	41.1					
IRZB-70	3						1200	38.9					
IRZB-71	3						1200	36.7					
IRZB-72	3						1200	34.4					
IRZB-73	3						1200	36.7					
IRZB-74	3						1200	41.1					
IRZB-75	3						1200	38.9					
IRZB-76	3						1200	36.7					
IRZB-77	3						1200	35.9					
IRZB-78	3						1200	33.7					
IRZB-79	3						1200	31.4					
IRZB-80	3						1200	40.4					
IRZB-81	3						1200	38.2					

Table 2. Field Data Sheet - IRZ Injuection
Former Boeing C-6 Facility, Los Angeles, California

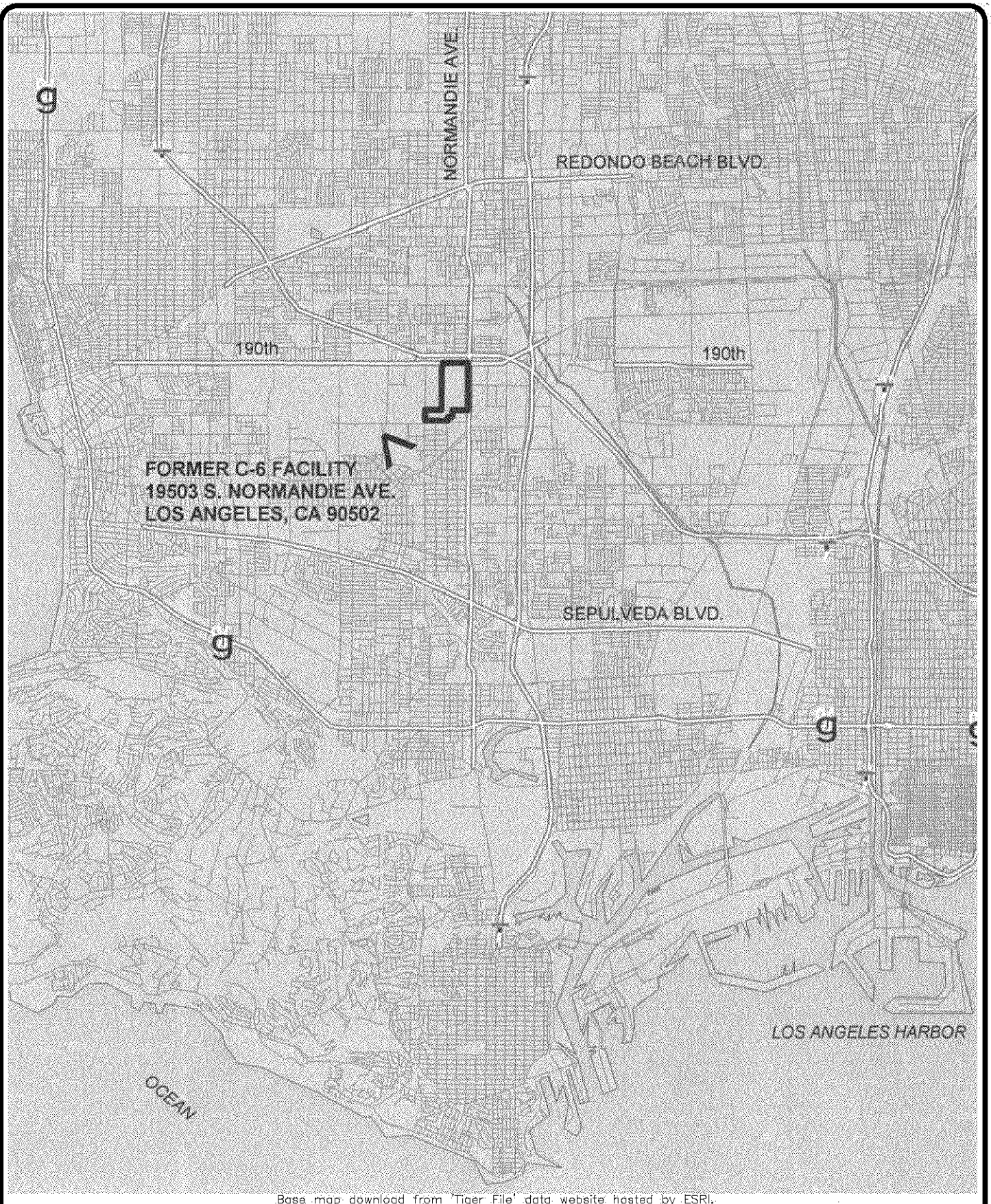
Amendment Point #	Vault #	Date	Start Time	End Time	Injection Data						Carbo-hydrate Solution	Tanker Truck Load #	Comments
					Totalizer Readings		Design Injection Volume	Estimated Headloss @ 7.5 gpm	Actual Injection Pressure	Injection Flowrate			
					Initial	Final	(gals)	(psi)	(psi)	(gpm)	(%)		
IRZB-82	3						1200	35.9					
IRZB-83	3						1200	33.7					
IRZB-84	3						1200	32.9					
IRZB-85	3						1200	30.7					
IRZB-86	3						1200	28.4					
IRZB-87	3						1200	38.9					
IRZB-88	3						1200	36.7					
IRZB-89	3						1200	34.4					
IRZB-90	3						1200	32.2					
IRZB-91	3						1200	29.9					
IRZB-92	3						1200	27.7					
IRZB-93	3						1200	25.4					
IRZB-94	3						1200	33.7					
IRZB-95	3						1200	31.4					
IRZB-96	3						1200	29.2					
IRZB-97	3						1200	26.9					
IRZB-98	3						1200	24.7					
IRZB-99	3						1200	22.4					

Table 2. Field Data Sheet - IRZ Injection
Former Boeing C-6 Facility, Los Angeles, California

Amendment Point #	Vault #	Date	Start Time	End Time	Injection Data						Carbo-hydrate Solution	Tanker Truck Load #	Comments
					Totalizer Readings		Design Injection Volume	Estimated Headloss @ 7.5 gpm	Actual Injection Pressure	Injection Flowrate			
					Initial	Final	(gals)	(psi)	(psi)	(gpm)	(%)		
IRZC-1	4						960	35.9					
IRZC-2	4						960	38.2					
IRZC-3	4						960	38.2					
IRZC-4	4						960	35.9					
IRZC-5	4						960	33.7					
IRZC-6	4						960	35.9					
IRZC-7	4						960	22.4					
IRZC-8	4						960	24.7					
IRZC-9	4						960	26.9					
IRZC-10	4						960	29.2					
IRZC-11	4						960	31.4					
IRZC-12	4						960	33.7					
IRZC-13	4						960	24.7					
IRZC-14	4						960	26.9					
IRZC-15	4						960	29.2					
IRZC-16	4						960	31.4					
IRZC-17	4						960	33.7					
IRZC-18	4						960	34.4					
IRZC-19	4						960	32.2					
IRZC-20	4						960	34.4					

ARCADIS

Figures



Base map download from 'Tiger File' data website hosted by ESRI.

ARCADIS

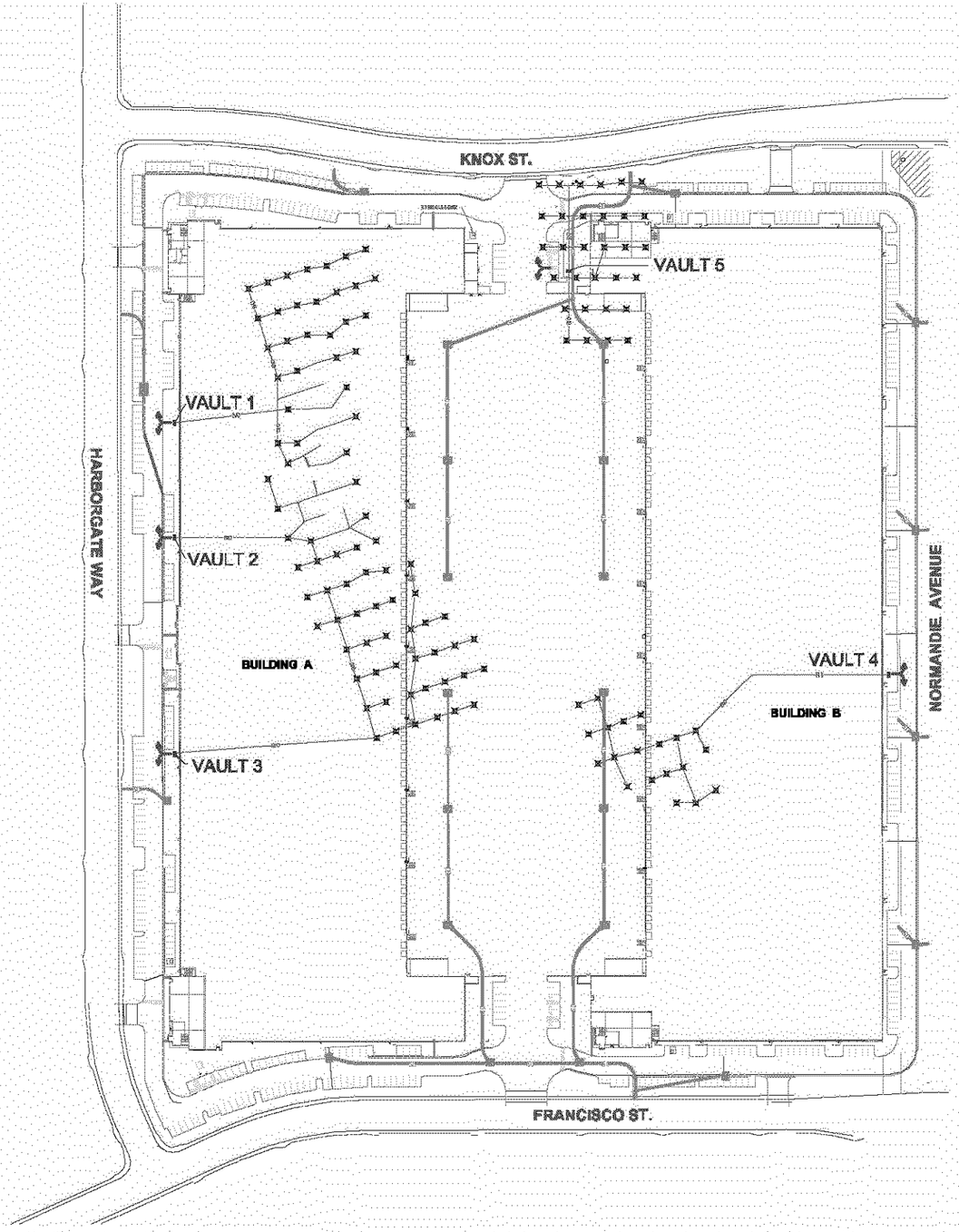
SITE LOCATION

BOEING REALTY CORPORATION
FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA

FIGURE
1

DATE: 11/5/03 | 13:36 | PRJ#: CA 594.03.01 | DWG: C:\drawings\project\boeing\2003\sl-1 | FILE: | CHK: LOTHMAN | PM: NGUYEN | ART: QUINONES

DATE: 11/5/03 | 11:30 | PRJ#: CA 594.03.01 | DWG: G:\drawings\project\boeing\2003\Vaults | CHK: LOTHMAN | PM: NGUYEN | ART: QUINONES



LEGEND

- VAULT 1 — FLUSH MOUNTED INJECTION VAULT FOR SUBSURFACE BIOREMEDIATION PIPING
- SD — STORM DRAIN WITH STORM GRATE
- BIO — BIOREMEDIATION SYSTEM PIPING
- NEW SINGLE BIOINJECTION POINT (BELOW SLAB / GRADE)
- LIKELY FLOW PATH OF SPILL

N

0 150
SCALE: IN FEET

BASE MAP PROVIDED BY HILL PINKERT ARCHITECTS, INC. IN FEBRUARY 2003
FIRE PROTECTION LINE PROVIDED BY ADVANCO FIRE PROTECTION IN FEBRAURY 2003
STORM DRAIN AND SEWER PROVIDED BY THIENES ENGINEERING, INC. IN FEBRAURY 2003

ARCADIS

INJECTION VAULTS AND STORM WATER DRAINAGE LAYOUT

BOEING REALTY CORPORATION
FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA

FIGURE
2

DATE: 1/16/04 | 11:30 | PRJ#: CA. 594.03.01 | OWG: G:\drawings\project\boeing\2003\Trucks-rev1 | FILE: | CHK: LOTHMAN | PM: NGUYEN | ART: QUINONES

HARBORGATE WAY

VAULT 1
(5'W x 9'L x 3'D)

VAULT 2
(4'W x 6'L x 3'D)

OFFICE

BUILDING A
419,695 S.F.
F.F. 54.54

VAULT 3
(5'W x 8'L x 3'D)

VAULT 4
(4'W x 6'L x 3'D)

BUILDING B
428,952 S.F.
F.F. 53.54

LEGEND

VAULT 1 — NEW FLUSH MOUNTED VAULT FOR SUBSURFACE REMEDIATION PIPING (VAULT DIMENSIONS AS SHOWN)

PICK-UP TRUCK WITH INJECTION MANIFOLD

TANKER TRUCK

N

0 40 80
SCALE: IN FEET

BASE MAP PROVIDED BY HILL PINKERT ARCHITECTS, INC. IN FEBRUARY 2003
FIRE PROTECTION LINE PROVIDED BY ADVANCO FIRE PROTECTION IN FEBRAURY 2003
STORM DRAIN AND SEWER PROVIDED BY THIENES ENGINEERING, INC. IN FEBRAURY 2003

ARCADIS

TRUCK LAYOUT

BOEING REALTY CORPORATION
FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA

FIGURE
3

BOE-C6-0008951

DATE: 11/5/03 | 11:30 | PRJ#: CA .594.03.01 | DWG: G:\drowings\oproject\boeing\2003\Alt: Trucks | FILE: | CHK: LOTHMAN | PM: NGUYEN | ART: QUINONES

HARBORGATE WAY

VAULT 1
(5'W x 9'L x 3'D)

VAULT 2
(4'W x 6'L x 3'D)

OFFICE

BUILDING A
419,695 S.F.
F.F. 54.54

VAULT 3
(5'W x 6'L x 3'D)

BUILDING B
428,952 S.F.
F.F. 53.54

VAULT 4
(4'W x 8'L x 3'D)

LEGEND

VAULT 1 — NEW FLUSH MOUNTED VAULT FOR SUBSURFACE REMEDIATION PIPING (VAULT DIMENSIONS AS SHOWN)

PICK-UP TRUCK WITH INJECTION MANIFOLD

TANKER TRUCK

N

0 40 80
SCALE IN FEET

BASE MAP PROVIDED BY HILL PINKERT ARCHITECTS, INC. IN FEBRUARY 2003
FIRE PROTECTION LINE PROVIDED BY ADVANCO FIRE PROTECTION IN FEBRAURY 2003
STORM DRAIN AND SEWER PROVIDED BY THIENES ENGINEERING, INC. IN FEBRAURY 2003

ARCADIS

ALTERNATE TRUCK LAYOUT

BOEING REALTY CORPORATION
FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA

FIGURE
4

ARCADIS

Appendix A

Public Information Sheet

PUBLIC INFORMATION SHEET

Site Information:

Former Boeing C-6 Facility located on Harborgate Way, Los Angeles, California

Project Information:

Boeing Realty Corporation (BRC) is currently working with the Los Angeles Regional Water Quality Control Board (RWQCB) to remediate groundwater impacted with volatile organic compounds (VOCs). To facilitate groundwater remediation, *In-Situ* Reactive Zone (IRZ) technology was selected to treat VOCs. IRZ involves the addition of a food grade carbohydrate solution to amendment points to create a reactive zone in the groundwater to optimize and enhance biodegradation of VOCs.

The current activity at the site includes the addition of a carbohydrate solution to the amendment points. A network of groundwater monitoring wells has been installed at the site to monitor the remediation progress. The selected treatment method is beneficial to the environment in many ways:

- There is no treatment equipment or compound;
- There is no groundwater pumped to the surface for treatment and eventual disposal;
- Typically faster remediation than the pump-and-treat technologies; and
- Minimal site disruption of operations.

Agency Approvals:

California Regional Water Quality Control Board – Los Angeles Region

Contact Information:

For further information, please contact the following:

Robert Scott – Project Manager, Boeing	(562) 593-8623
John Scott – Technical Specialist, Boeing	(562) 586-4533
James Nguyen – Project Manager, ARCADIS	(714) 278-0992
Eric Lothman – Project Engineer, ARCADIS	(714) 278-0992